tradition (along the lines of 'the mean content of bases G and C of sequence so-and-so is 47.8 per cent'). Technical development has always had that effect on scientific disciplines, for example the electron microscope, the radio telescope or the automated DNA sequencer.

Of course, researchers are always quick to emphasize the importance of their work to whatever application is in vogue, and curing diseases is a worthy goal. But how specifically will the Human Genome Project help to achieve this end? A look at any gene (as opposed to a sequence) map from any species reveals what looks like an explosion in a slaughterhouse. Where is the order we need, to make sensible rather than trial-and-error genetic manipulations?

Should scientists' claims of applicability for their results be acknowledged as a mechanism to secure funding rather than having any realistic basis? 'Science is a process and not a series of final states' is the somewhat trite argument to justify goals not achieved. A series of simple descriptive, but highly technical, publications ensures that research money will be channelled into well-trodden paths in the future.

In any case, pharmacogenomics requires an understanding of the apparent genetic 'disorder' in any organism's genome, of genotype–phenotype mapping, of gene–gene interactions (epistasis), of intraspecific genetic variability, and of self-organizational processes, rather than endless lists of DNA bases.

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Genes: we can't expect full understanding yet

Sir — The editing of one phrase in our statement about ownership of the human genome[1] might lead readers to misconstrue our intention. In the sentence printed as "The intention of some university and commercial interests to patent the DNA sequences themselves, thereby staking claim to large numbers of human genes without necessarily having a full understanding of their functioning, strikes us as contrary to the essence of patent law", the word "full" should have been deleted.

In fact, the full understanding of a gene is likely to take many decades to accomplish, and such a criterion would clearly be unreasonable with respect to what is patentable. Our point is that some level of understanding of specific function is important before a patent is awarded, as this is a necessary precursor to the claim of a substantial utility.

We also wish to comment that it is not the case, as implied in the Opinion article in the same issue[2] that the main target of our statement was Celera Genomics. We were addressing important issues of broad public policy, and our focus was primarily the patent offices and the law courts, in which the validity of claims for gene-sequence patents will be decided.

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1. *Nature* **404,** 305 (2000).
2. *Nature* **404,** 317 (2000).

Garlic study vindicated by official investigation

Sir — Your News story "German garlic study under scrutiny"[1] reports allegations of data manipulation and incorrect data analysis raised in a German newspaper about a study we carried out using a garlic preparation called Kwai. They were made after the results of our clinical study "Randomized placebo-controlled double-blind study on antiatherosclerotic effect of Kwai in common carotid arteries and femoral arteries" were published[2].

As mentioned in your story, an official committee at Humboldt University was set up to investigate the claims of falsification. It has now announced that the accusation of data manipulation is unfounded.

The investigating committee has found that the clinical trial had been sanctioned in advance by the relevant ethics committee and that the patients had agreed individually, in writing, to participate. The use of an alternative statistical evaluation was explained in detail in our original article[2], but we have clarified this matter in a letter to the same journal[3].

We have also confirmed the plaque reduction reported in our published article[2] by two more ultrasound photos of the same patient from the verum group (with initials and date at the same examination time) using the sector scanner, a different ultrasound system (data not shown). We have examined and confirmed the reproducibility of our earlier ultrasound photos, and we will present our confirmatory findings in a future article.

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1. *Nature* **401,** 629 (1999).
2. Koscielny, J. *et al. Atherosclerosis* **144,** 237–249 (1999).
3. Siegel, G. *Atherosclerosis* **148** (in the press).

Learn lateral thinking first and specialize later

Sir — Frederick Seitz's Millennium Essay, "Decline of the generalist"[1], voices an important truth about narrow specialization in science. The twentieth century was the age of scientific specialization, and in many areas this will continue.

However, the pendulum begins to swing back. *Nature* readers can hardly have overlooked those systems that today challenge science and society: geophysiological systems of ocean, weather and global warming; biophysical–mathematical systems such as brain function and animal behaviour; and other natural systems, large and small. All of these trample briskly across traditional scientific boundaries. So is there not a new urgency about the inter- and multidisciplinary teaching of science? Should we not prepare science graduates whose careers will take other directions to understand something of the science and technology that will dominate their world?

General and specialist aims in scientific education are not incompatible. The answer is to offer university science courses broad enough to encourage lateral thinking across two or more disciplines, while positioning the graduate to embark upon specialization in one area. Additional specialist training can readily be acquired later, but the habit of lateral thought cannot — it must come first. Only some students will wish to follow this track into science, which makes its own special intellectual demands, but they will be better for doing so.

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1. *Nature* **403,** 483 (2000).

Religion has its place but don't pretend it's science

Sir — I protest most strongly at Geoffrey Cantor's statement in his Millennium Essay[1] that I have made tirades against religion and that I regard it as the enemy of science. This is simply false; see what I have written on this topic, as in my *Unnatural Nature of Science* (Faber, London, 1993).

I do, however, follow David Hume, who made clear that religion is based on faith, science on reason. I only oppose religion in relation to science when people make scientific claims for it, for example in supporting creationism.

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1. *Nature* **403,** 831 (2000).